Application of IWR-MAIN Procedures to California Urban Water Use Forecasting

(General procedures from IWR-MAIN Water Demand Management Suite User's Manual and System Description, 1999, developed by Planning and Management Consultants, Ltd., Carbondale, IL)

Forecast Manager

Procedure:	Comments:
1. Create a New Database	Forecast Manager operates from an Access data file with the extension *.mdb*. There will be a unique data file for every Study Area.
2. Define Study Area	The software allows the user to Add, Delete, or Replicate study areas. The Study Areas are associated with a database file. The initial run of IWR-MAIN will be completed as a Planning Area (PA) by County study. For example, one file would contain PA 508, which may contain sub-areas such as Butte, Plumas, Sierra, Nevada, and Yuba county sections.
3. Select Sectors/Subsectors	The user selects the customer classes. The sectors are divided into Residential and Non-Residential, and then the user can further select subsectors including Single-family and Multi-family, as well as Commercial, Manufacturing, and Government. The Sectors and Subsectors selected for the model run are: ➢ Residential - Single-family - Multifamily ➢ Non-Residential - Commercial - Industrial - Large Landscape

4. Select the Forecasting Model	For each sector/subsector, the user selects from one of four forecasting methods: ▪ **Constant Use Rate** (calculates the base year per unit water use rate times the number of counting units for each subsector) ▪ **Build Forecasting Model** (allows the user to adjust the per unit usage rate with information about selected explanatory variables) ▪ **Multiplicative Model** (the user must develop a multiplicative predictive model prior to using the software) ▪ **Linear Model** (the user must develop a linear predictive model prior to using the software) The Build Forecasting Model will be the primary method used to forecast California urban water use. It allows the modeler to choose variables and usage rates.
5. Define Forecast Years	The user enters in the base year and forecast years for the current study area. IWR-MAIN considers the earliest year entered to be the base year. The years chosen are 2000, 2010, 2020, and 2030.
6. Select Model Variables	The user selects the model variables for each subsector, including: ▪ **Income** – Median household income ▪ **Housing Density** – Housing units per acre ▪ **Persons per Household** – Average number of persons per household. ▪ **Marginal Price** – The price paid for the last unit of water plus any wastewater volume charge. ▪ **Average Daily Maximum Temperature** – Average maximum temperature for the month. ▪ **Precipitation** – Total number of inches of rainfall for the month. ▪ **Cooling Degree Days** – cumulative number of degrees for the month by which the daily average temperature exceeds 65 F.

The model variables selected for the sectors are:

- Residential
  - Income
  - Housing Density
  - Persons per Household
  - Marginal Price
  - Average Daily Maximum Temperature
  - Precipitation
- Non-Residential

  Commercial/Industrial
  - Marginal Price
  - Cooling Degree Days

  Large Landscape
  - Average Daily Maximum Temperature
  - Precipitation

7. Associate Counting Units with Subsectors

The user selects the counting units to be associated with each subsector (e.g., housing units, employee counts, etc).

The selected counting units are:

- Residential
  - Housing units
- Non-Residential

  Commercial/Industrial
  - Employee counts

  Large Landscape
  - Total Population

8. Enter Base Year Water Use	The user enters water use for each month by subsector in gallons, thousand gallons, or million gallons.
9. Enter Number of Counting Units	The user enters in the number of counting units for each subsector for the base and forecast years.
10. Enter Model Intercepts	The software allows the user to enter model intercept values for each subsector for base and forecast years, if the multiplicative forecast model or the linear forecast model were selected.
11. Enter Values of Model Variables	The user enters the values for each explanatory variable for each subsector for base and forecast years. The variables are used in each of the forecasting methods except for the constant use rate method.
12. Enter Constant Elasticities	Used in the multiplicative and the Build Forecast models, user enters in elasticity values by month for each explanatory variable selected for each subsector.
13. Enter Linear Coefficients	Used for the linear model, the user enters in coefficient values by month for each explanatory variable.
14. Enter Conservation Savings	The user has the option to enter in the conservation savings by subsector and year. The savings may be entered as either a percent of subsector water use or in gallons per unit per day. A much more detailed level of conservation savings can be performed by using Conservation Manager.
15. Enter Peak Demand Values	The user has the option of entering the base year System Peak Demand for the study area, measured in gallons per day, thousand gallons per day, or million gallons per day.
16. Enter Unmetered/Unaccounted Demand Fraction	The user enters in the percent of total water that is unaccounted for for the base year. This difference may be due to unmetered water use, system losses, line flushing, firefighting, meter slippage, or illegal water use.
17. Optional Sensitivity Analysis	The user can perform sensitivity analyses on Linear Coefficients, Constant Elasticities, Model Variable Values, and User Count Values. This is done by entering low and high numbers for each analysis.
18. Optional Statistical Uncertainty	The user can calculate confidence intervals for the water demand forecast.
19. Generate Forecast	The user may select to calibrate the water use models to the base year water use. Other options are to Forecast with Sensitivity, or to Forecast

	with Uncertainty.
20. Define Seasons	The user may associate months with each season.
21. Reports	The user can choose from different report options: Water Use, Per Unit Water Use, and Forecast/Restricted Water Use. The user selects a single study area or multiple study areas that have forecasts generated for them. The report may be viewed with monthly or yearly values, seasonally, and the user may choose the units in which to display the water demand values (gallons, thousand gallons, million gallons, acre feet, or hundred cubic feet). The report can be displayed with or without conservation demand.
22. Graph Options	The report may be viewed as a Water Use Graph or a Distribution Graph. The graph may be printed or exported to another program such as Excel.

Conservation Manager

Procedure:	**Comments:**
1. Create a New Database	The Conservation Manager operates from an Access data file with the extension .mdb.
2. Import Data	The user has the option to import data (for items #3,4,5,6,9, & 11) for a study area from a Forecast Manager data file. The import option will bring in the baseline forecast as well as variables for each subsector.
3. Define a Study Area	Within a data file, the user may create any number of study areas. Multiple forecasts or alternative analyses may be developed by replicating a study area, modifying input data, and generating a new forecast or estimate of savings.
4. Select Sectors/Subsectors	The user selects the sectors and subsectors (e.g., Residential and Single-Family).
5. Define Forecast Years	The user enters the base year and forecast years for the study area.

6. Associate Counting Units with Subsectors	The user selects the counting units to be associated with each subsector (e.g., housing units, employee counts, etc).
7. Intensity	The user can specify how data for the intensity parameter (e.g. how many times a toilet is flushed each day) for each end use is to be entered.
8. Plumbing Code	The user can input information related to plumbing codes.
9. Enter Base Year Water Use	The water use is entered for the base year for each subsector per month. The data can be entered in gallons, thousand gallons, million gallons, acre feet, or hundred cubic feet per month.
10. Enter Percent Indoor Base Year Water Use	The user can enter the percent of total water use that is indoor water use for each subsector. Each end use is designated as either an indoor or outdoor use.
11. Enter Number of Counting Units	The user enters in the number of counting units for each subsector.
12. Enter End Use Data	The user enters parameter data for each end use. These include presence parameters (e.g., the percentage of housing units in the single-family subsector which have a toilet) and saturation parameters (what is the percentage of single-family housing units which have Ultra-Conserving toilets?).
13. Baseline Forecast	If data for a study area have been imported from the Forecast Manager, the baseline forecast will be the imported water demand forecast. Otherwise, water use is entered in gallons per day by subsector for each forecast year. The Baseline Forecast allows calibration of the end use forecast.
14. Select Intensity Variables	If data has been imported from Forecast Manager, the variables selected by subsector in the Forecast Manager file will automatically be selected. Otherwise, the user selects the Model Variables (see #6 of Forecast Manager procedures).
15. Enter Values of Intensity Variables	The user can enter the values for each intensity variable for each subsector.
16. Enter/Build Intensity Values/Model	The user can enter the intensity values for the end use, by month or by function.
17. Enter Unmetered/Unaccounted Demand Fraction	The user enters in the percent of total water that is unaccounted for. This difference may be due to unmetered water use, system losses, line flushing, firefighting, meter slippage, or illegal water use.

18. Enter Peak Demand Values	The user has the option of entering the base year System Peak Demand for the study area, measured in gallons per day, thousand gallons per day, or million gallons per day.
19. Enter Passive Conservation	Passive conservation refers to shifts in the water use efficiency levels of an end use caused by natural replacement, self-retrofitting, and compliance with water efficiency ordinances. The user may enter a retrofit rate, and two types of natural replacement rates.
20. Enter Active Conservation	The user enters data describing active conservation programs. Active conservation savings occur when units are shifted from lower levels of water use efficiency to higher efficiency levels for a given end use as a result of a utility-sponsored conservation program.
21. Emergency Conservation	This option allows the user to enter data regarding emergency conservation programs. An emergency conservation program is a temporary program such as mandated water restrictions or prohibitions.
22. Generate Forecast	The user generates the end use estimates and water forecast. The user may choose to calibrate the end use estimates and water forecast in a variety of ways. The user may also select to generate the forecast with or without conservation.
23. Specify Report Options	This procedure allows the user to specify the format of the water use forecast to display the report in the following manners: ▪ Distribution Report – for indoor/outdoor distribution report. ▪ Conservation Savings Report – for water conservation savings. ▪ Statistic Report – for statistics on the conservation data inputs. ▪ Saturation Parameter Report – for review of the saturation parameters. ▪ Water Use Graphs – for graphing water use. ▪ Distribution Graphs – for creating pie charts of the water use forecast.
24. Specify Export Options	This allows the user to export the water use forecast to other electronic formats, such as HTML, Excel (.xls), or MS-DOS text (.txt).